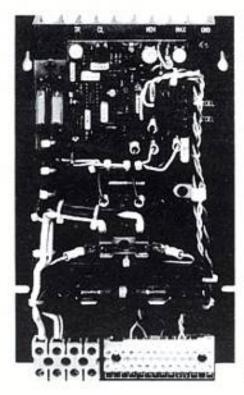
5 HP

Chassis Mount Solid State DC Motor Speed Control Model

KBCC-255

Installation and Operating Instructions*

*See Safety Warning on Page 2.



5K Remote Potentiometer



Knob with Dial Plate. (Accessory item not included)



KB Part No. 9832

Model KBCC-255

- Designed for PM and Shunt Motors—rated 180VDC
- Includes Armature and Control Fusing
- Separate Power Bridge Cube
- Current Limit Led Indicator

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A COMPLETE LINE OF SCR DRIVES

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SAFETY WARNING-PLEASE READ CAREFULLY

This product should be installed and serviced by a qualified technician, electrician or electrical maintenance personnel familiar with its operation and the hazards involved. Proper installation which includes wiring, mounting in proper enclosure, fusing or other overcurrent protection and grounding, can reduce the chance of electric shocks, fires or explosion in this product or products used with this product, such as electric motors, switches, coils, solenoids and/or relays. Eye protection must be worn when working with control under power. This product is constructed of materials (plastics, metals, carbon, silicon, etc.) which may be a potential hazard. Individual material safety data sheets (MSDS) are available upon request. Proper shielding, grounding and filtering of this product can reduce the emission of radio frequency interference (RFI) which may adversely affect sensitive electronic equipment. If information is required on this product, contact our factory. It is the responsibility of the equipment manufacturer and individual installer to supply this safety warning to the ultimate user of this product. (SW effective 3/88).

IMPORTANT

Read these simplified instructions before operating control.

- Be sure input AC line voltage corresponds to control voltage. (240 VAC—50/60 Hz 1φ).
- Recheck connections: AC line to L1 and L2; armature to A+ and A- and Field (Shunt motors only) to F+ and F-. Connect ground via ground screw (Note: If motor runs in improper direction, interchange armature leads).
- Nominal trimpot settings are as follow (expressed in % of full CW rotation):

TABLE 1: NOMINAL TRIMPOT SETTINGS

DECEL (deceleration):

MIN (minimum speed): 15% For detailed instructions see MAX (maximum speed): 65% Sec. III
IR (IR compensation): 25%
CL (current limit/torque): 75%
ACCEL (acceleration start): 30%

0%

FOR TECHNICAL ASSISTANCE CALL TOLL FREE (NY STATE ONLY) 1-800-221-6570

LIMITED WARRANTY

For a period of 18 months from date of original purchase KB will repair or replace without charge devices which our examination proves to be defective in material or workmanship. This warranty is valid if the unit has not been tampered with by unauthorized persons, misused, abused, or improperly installed and has been used in accordance with the instructions and/or ratings supplied. The foregoing is in lieu of any other warranty or guarantee expressed or implied, and we are not responsible for any expense (including installation and removal), inconvenience, or consequential damage, including injury to any person, caused by items of our manufacture or sale. Some states do not allow certain exclusion or limitations found in this warranty so that they may not apply to you. In any event, KB's total liability, under all circumstances, shall not exceed the full purchase price of this unit. (Rev. 10/84)

The information contained in this brochure is intended to be accurate. However, the manufacturer retains the right to make changes in design which may not be included herein.

TABLE 2. ELECTRICAL RATINGS

MODEL NUMBER	AC VOLTS INPUT (50/60 Hz)	MAX. AC LOAD CURRENT (RMS AMPS)	MAX. DC LOAD CURRENT (AVG. AMPS)	MAX HP	FUSE SIZE (AMPS)
KBCC-255	240	38	26	5	40

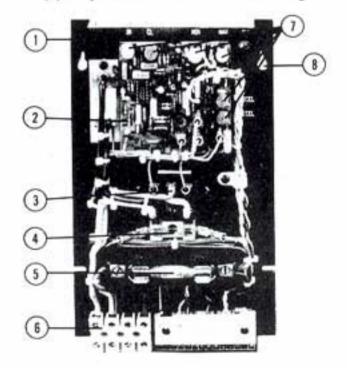
TABLE 3. GENERAL PERFORMANCE SPECIFICATIONS

Speed range (ratio)
ACCEL/DECEL time range (0-full speed)
(secs.)
Min. speed trimpot range (% full speed) 0-30*
Max. speed trimpot range (% full
speed)
IR compensation trimpot range (at specified full
load) (volts)
Maximum allowable ambient temperature at full
rating (°C/°F)
Tachometer feedback input volts (per 1000 RPM) (VDC)
\$ \(\frac{1}{2} \)

^{*}Performance is for SCR rated PM motors only. Lower performance can be expected with other motor types. Factory setting is for 3% load regulation. To obtain superior regulation, see Sec. III F. (page 11). Other factory trimpot settings are as follows: CL-150% FL, ACCEL-3 secs., MIN-(0)-speed, MAX-full speed & IR-3 volts.

FIG. 1. FEATURES AND FUNCTIONS

- (1) Rugged Aluminum Heatsink
- (2) KBMM Speed Control
- (3) Power Bridge Module
- (4) Control Fuse (4A)
- (5) Armature Fuse (40A)
- (6) Barrier Terminal Block
- (7) Trimpots: MIN, MAX, ACCEL, DECEL, IR and CL
- (8) Keyhole slots facilitate mounting



INTRODUCTION

The KBCC[™] Full Wave Solid State DC Motor Speed Control represents the latest state-of-the-art design achievable through modern technology.

Features Include:

Integrated Circuitry

Used to control and amplify command and reference levels with both closed and open loop feed-back to provide superior motor regulation. (Speed changes due to load, line voltage, or temperature variations are held to minimum levels).

High Quality Components

Selected and tested for proven dependability.

Transient Protection

Used to prevent failure of the power bridge circuit caused by voltage spikes on the AC Line.

High Reliability

When used in accordance with the instructions included in this manual, the KBCC™ will provide years of trouble-free operation.

SECTION I. APPLICATION INFORMATION

- A. Motor Type. The KBCC™ is designed for Permanent Magnet (PM) and Shunt Wound D.C. motors. Controls operated on 240 volt AC inputs are designed for 180 volt SCR rated motors. Use of higher voltage motors will result in degradation of full speed performance. Also, if motor is not an SCR rated type, the actual AC line amperage at full load should not exceed the motor's DC nameplate rating.
- B. Torque Requirements. When replacing an AC induction motor with a DC motor and speed control, consideration must be given to the maximum torque requirements. The full load torque rating of the DC motor must be equal to, or greater than, that of the AC motor.
- C. Acceleration Start. The KBCC™ contains an adjustable acceleration start feature which allows the motor to smoothly accelerate from 0-full speed over a time period of 1-10 seconds. The "ACCEL" is factory set at 3 seconds.
- D. Limitations in Use. The KBCC™ controls are designed for use on machine applications.

CAUTION: Consult factory before using on constant horsepower applications such as saws or drill presses. Do not use in explosive atmosphere.

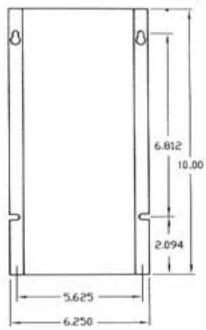
CAUTION: Be sure the KBCC* is used within its max. ratings. Follow all installation instructions carefully. (Refer to Section II.)

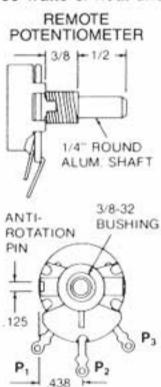
SECTION II. INSTALLATION INSTRUCTIONS

A. Location and Mounting. The KBCC™ controls should be mounted on a flat surface and located in an area where it will not be exposed to contaminants such as water, metal chips, solvents or excessive vibration.

When mounting in an enclosure the air space should be large enough to provide adequate heat dissipation. The maximum allowable amibent temperature at full rating is 45°C/113°F. Consult factory if more information is required. Note: Control dissipates approx. 60 watts of heat under full load.

FIG. 2 MECHANICAL SPECIFICATIONS (inches)





B. Initial Setup and Wiring

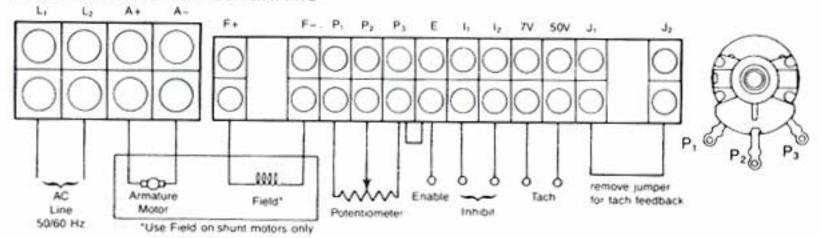
- The KBCC can be connected to a standard 240V 50/60 Hz AC line [Be sure the AC input voltage corresponds to the control voltage rating and the motor rating (e.g. 180VDC motor on 240VAC)].
- 2. Follow the recommended supply wire sizes as per Table 5.
- 3. Follow the NEC and other electrical codes that apply.
- 4. Connect control in accordance to connection diagram-See Fig. 3.
- Use separate branch fuse or circuit breaker protection for each ungrounded AC main input line.

TABLE 4. MINIMUM SUPPLY WIRE SIZE REQUIREMENTS [AC Line and Armature]

		MINIMUM WIRE SIZE (AWG) Cu Only		
MAX. MOTOR AMPS (DC AMPS)	MAX. MOTOR HP 180V	MAX. 50 FOOT RUN	MAX. 100 FOOT RUN	
26	5	10	8.	

[&]quot;Maximum recommended wire size. (Maximum tightening torque is 20 in. lbs.)

FIG. 3 CONNECTION DIAGRAMS



Field Voltage

Use F+ and F- for 200VDC field. Use F+ and L1 for 100VDC field.

Tachometer Connection (Note: DC Tachs Only)

- (1) For tach feedback, remove jumper between terminals J1 and J2.
- (2) Connect tach as follows:
 - (a) 7 volts/1000 RPM Connect (+) lead to Terminal 7V

Connect (-) lead to Terminals I2 or F-

(b) 50 volts/1000 RPM Connect (+) lead to Terminal 50V

Connect (-) lead to Terminal I2 or F-

Application Note: Set IR Comp trimpot to minimum setting (full ccw rotation) when using tach feedback.

CAUTION: If control is wired to a transformer, it is advisable to switch the secondary to disconnect power. If the primary is switched, additional snubber capacitors may have to be added across the transformer output to prevent damage to the power bridge.

CAUTION: Do not bundle control wires P1, P2, P3, I1, I2 with line or motor leads. If wires are over 18" use shielded cables.

WARNING: Armature Switching. Do not switch the armature in and out of circuit unless Inhibit Circuit is used or catastrophic failure will result.

C. Voltage Following.

All models can be controlled with an isolated analog reference voltage (0-9VDC) in lieu of the main speed potentiometer. The voltage is connected to $P_2(+)$ and F_- . The control output voltage will linearily follow the input voltage. The source impedance of the input should be 10K ohms or less. The Minimum Speed Trimpot (MIN) can be used to provide an offset speed. If an offset is not required, adjust the MIN to 0+ or 0- speed as desired. The Max trimpot is rendered inoperative in the voltage following mode. Use an auxiliary trimpot to limit the control range. If the input signal is not isolated, or is a current signal (4-20ma), the KBSI-240D Signal Isolator must be used. It will allow direct connection to process controllers and microprocessors.

CAUTION: 1. The voltage feeding P₂ and F- must be isolated from the AC line. Do not ground P₂ or F- to set up a zero or ground reference.

 Do not bundle signal wires to P₂ and F – with AC line or motor connections. If signal wires are over 18", use shielded cables.

D. Fusing.

- Armature Fuse. The armature fuse provides overload protection for the motor and control. The KBCC control contains fuses that are rated for the maximum horsepower. To provide proper protection for motors rated less than maximum, fuse at approximately 1.7 times the DC amperage rating of the motor. (The factory installed fuse is rated 40A, type SC-40.)
- AC Line Fuse. The installer should provide fuse or circuit breaker protection for each ungrounded supply conductor. Use a 40A rated fuse (Buss type SC-40 or equiv.) Do not fuse neutral or grounded conductors.
- Control Fuse. A factory-installed 4A fuse (Type 3AG or equiv. ¼" x 1¼") is used to protect the Speed Control Module which provides logic to the power bridge and a separate field supply for the motor.

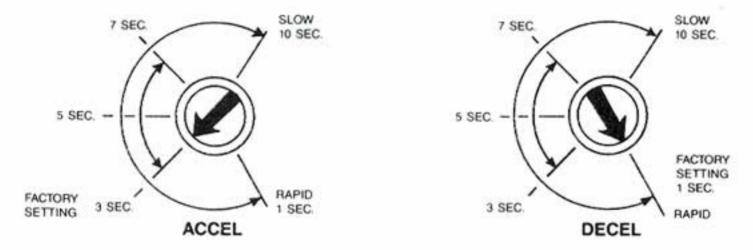
SECTION III—ADJUSTMENTS AND CONTROL FUNCTIONS

The KBCC has been factory adjusted to provide 0-full speed using the speed control knob. Minimum and Maximum speed trimpots are provided to change the speed from other than 0-full speed. The Acceleration (ACCEL) trimpot is provided to allow for a smooth start over an adjustable time period each time the AC power is applied or the speed pot is rotated. The DECEL trimpot controls the amount of ramp down time when the speed pot is adjusted to a lower speed. The Current Limit (CL, or torque output) adjustment is factory set to approximately 1½ times the motor rating. The IR Compensation (IR) is factory adjusted to provide excellent motor regulation under normal operation.

NOTE: Do not attempt to change the settings of the trimpots unless absolutely necessary since they are factory adjusted to near optimum settings.

The following procedure, presented in order of adjustment sequence, should be used when readjusting all trimpot functions:

Fig. 4 ACCEL/DECEL TRIMPOT ADJUSTMENT



- A. Acceleration Start. The ACCEL is factory set at approx. 3 seconds. To readjust to different times, set the knob to the desired position as indicated in Fig. 4.
- B. Deceleration. The DECEL is factory set to provide minimum ramp-down time. To increase the ramp-down time adjust the DECEL trimpot as indicated in Fig. 4.

C. Minimum Speed Adjustment. If a higher than zero minimum speed is desired, readjust the minimum speed by turning the speed control knob to zero setting (full CCW position). Then adjust the Min. Speed Trimpot to the desired setting.

NOTE: The min. speed adjustment will affect the max. speed setting. Therefore, it is necessary to re-adjust the max. speed after the min. speed.

D. Maximum Speed Adjustment. Turn Speed Control Knob to full speed (maximum CW position).
Adjust max. speed trimpot to new desired setting.

NOTE: Do not attempt to adjust the max. speed above the rated motor RPM since unstable motor operation may occur. For moderate changes in the max. speed, there will be a slight effect on the min. speed setting.

E. Current Limit (CL/Torque Adjustment). CL circuitry is provided to protect the motor and control against overloads. The CL also limits the inrush current to a safe level during startup. The CL is factory set to approximately 1.5 times the full load rating of the motor. (CL trimpot is nominally set to approx. 75% of full CW rotation.)

To set the CL to factory specifications adjust as follows:

- Set speed control knob at approximately 30-50% CW rotation. Set CL trimpot to full CCW position.
- Connect a DC ammeter in series with the armature lead.
- Lock shaft of motor (be sure CL pot is in full CCW position). Apply power and rotate CL pot CW slowly until DC ammeter reads 1.5 times motor rating (do not exceed 2 times motor rating).
- F. IR Compensation Adjustment. IR compensation is provided to substantially improve load regulation. If the load presented to the motor does not vary substantially, the IR adjustment may be set at a minimum level (approximately 1/4 of full setting). The control is factory adjusted to approximately 3% regulation. If superior performance is desired (less than 1% speed change of base speed from 0 to full load), then the IR comp. should be adjusted as follows:

NOTE: Excessive IR comp. will cause control to become unstable, which causes motor cogging.

- Set IR comp. trimpot at approximately 25% of CW rotation. Run motor unloaded at approximately 1/3 speed and record RPM.
- Run motor with maximum load and adjust IR comp. trimpot so that the motor speed under load equals the unloaded speed per step 1.
- Remove load and recheck unloaded RPM. If unloaded RPM has shifted, repeat procedure for more exact regulation.

The KBCC is now compensated to provide minimal speed change under large variations of applied load.

NOTE: For tach feedback applications the IR Comp can be set to minimum rotation (full ccw).

SECTION IV. SWITCHING CIRCUITS

A. Inhibit™ and AC Line Switching. The KBCC™ can be turned "on" and "off" using the AC Line. Auto Inhibit® circuitry contained in the KBCC™ automatically resets critical components each time the AC line is interrupted. This, along with Acceleration Start and CL, provides a smooth start each time the AC line is connected.

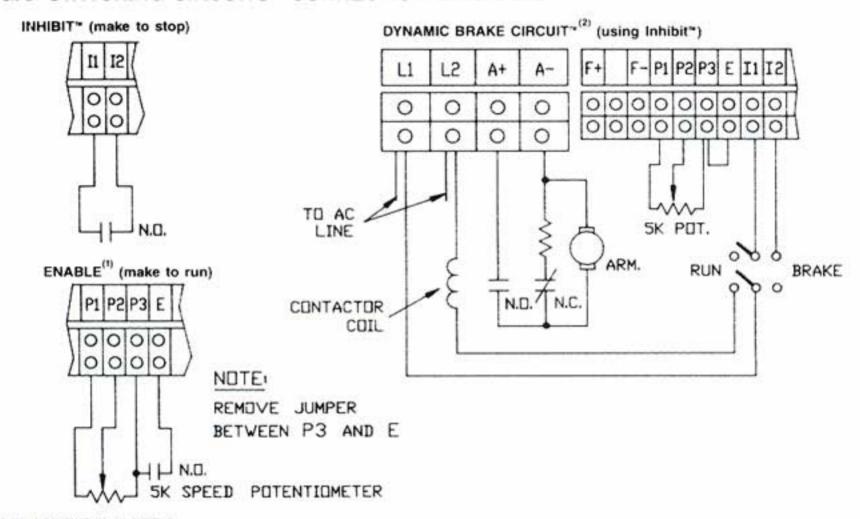
Warning: Do not disconnect and reconnect the Armature with the AC line applied or catastrophic failure will result. See armature switching.

B. Inhibit™ and Armature Switching. If the armature is to be disconnected and reconnected with AC power applied the Inhibit Circuit™ must be simultaneously activated and deactivated. Connect I₁ and I₂ together to activate the Inhibit Circuit™. When the Inhibit is activated, the control output will be electronically extinguished which eliminates arcing. See Fig. (5) for Dynamic brake circuit.

Warning: Do not use Inhibit as a failsafe or safety switch.

C. Reversing and Dynamic Brake. KB has developed the APRM® * which provides anti-plug "instant" reversing and solid state dynamic braking. The APRM® is built in as standard in all KBCC-R suffix models and in all KBPB™ models. *Patented [Note: 3 Horsepower maximum rating.]

FIG. 5. SWITCHING CIRCUITS—CONNECTION DIAGRAMS



APPLICATION NOTES:

- ENABLE: Stop time is adjustable with DECEL trimpot. To obtain zero speed when Enable is open MIN speed trimpot must be set to zero speed. Two speed operation can be obtained by setting the MIN speed to the desired level.
- DYNAMIC BRAKE: Choose RB resistance and wattage according to braking requirements. Inhibit Circuit extinguishes output of control during brake. When armature is reenergized the Inhibit releases and provides a smooth start. Choose relay or contactor with appropriate rating.

SECTION V. TROUBLESHOOTING GUIDE

The following Troubleshooting Guide is intended for use by a qualified technician. The Guide is designed to isolate common malfunctions of the KBCC and/or motor. It should be used with the parts lists and schematics contained in this manual.

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
 Motor does not run. 	 AC voltage not brought to L1, L2 terminals. 	 Correct wiring to control.
	Blown line or armature fuse.	 Replace blown fuse with SL-40 or equiv. If fuse blew due to miswiring, power bridge module may be defective.
	Speed control knob set to 0.	Turn knob CW to start motor.
	Defective motor.	 Check for defective motor, worn brushes, etc. Replace motor.
	CL trimpot set to min(ccw).	Adjust CL trimpot to 75%.
Motor hums, or runs at very low speed (with control knob set at	Low voltage.	 Check line voltage at control and rewire as required.
high number) or motor slows down substantially when load is applied.	Overload condition: control in current limit mode (CL) (trim- pot not set correctly.)	Reduce loading; CL trimpot setting may have to be in- creased. See Section IV.
	 Incorrect wiring. Armature and shunt connections inter- changed (shunt motor only). 	Correct wiring (armature has lower resistance than field).
Erratic motor performance.	 Defective motor, worn brushes etc. 	 Repair motor.
	Overload condition.	Remove overload.
	IR comp and/or CL trimpots not set properly.	Readjust trimpots as per Section IV.
	 Defective speed control module. 	Replace module.
Motor continues to run when speed control knob is set to 0.	 Min speed trimpot not set to proper position. 	 Readjust min. trimpot.
	IR comp trimpot set too high.	Lower IR comp trimpot setting.
Motor runs in wrong direction.	 Armature leads reversed. 	 Reconnect armature leads.
Motor runs full speed.	 Main speed pot wired incor- rectly. 	 Reconnect pot.
	Tachometer polarity reversed.	Interchange tach leads.

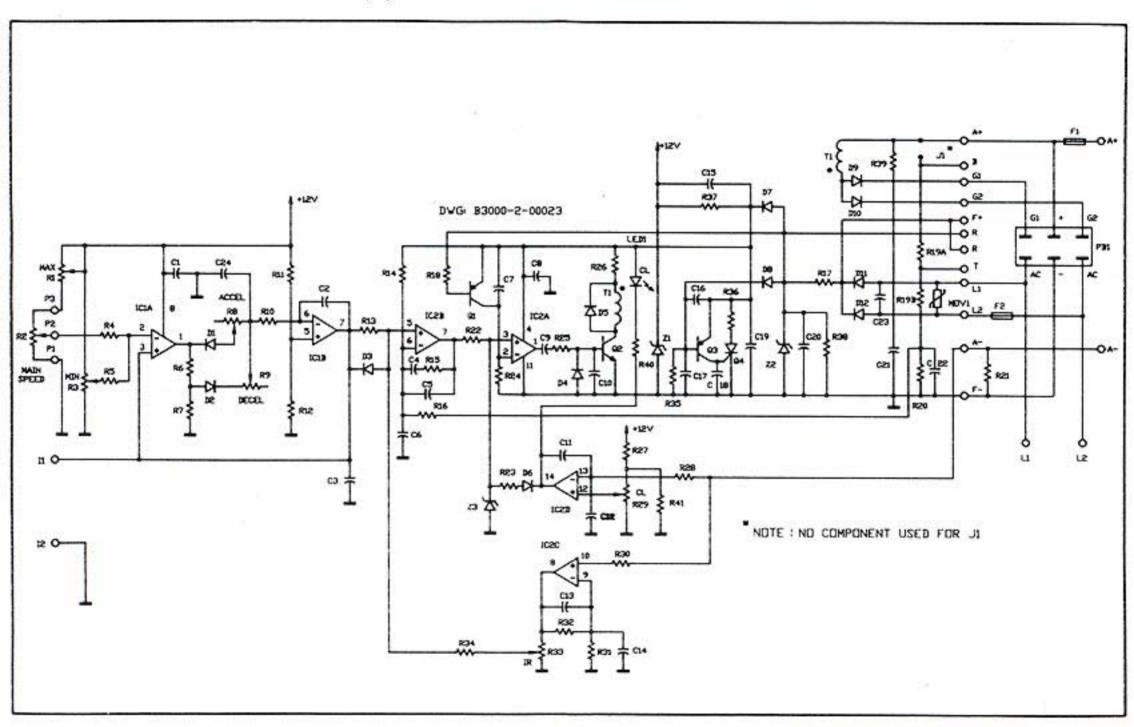
SECTION VI (A) SPEED CONTROL PARTS LIST MODEL KBCC-255—RATED 5HP-240V

CKT. REF.	VALUE/RATING	MFG. TYPE	FUNCTION	
C1.12 C14-16.18 C2 C3.24 C4 C5.7 C6.8.10 C9 C11.22 C13.20 C17 C19 C21 C23 C25 D1-10 D11.12 IC1 IC2	0.01ufd-25V 0.01ufd-25V 1.5ufd-50V 0.0039-0.0047ufd-25V 1.0ufd-60V 0.1ufd-63V 0.022ufd-25V 0.01ufd-63V 0.022ufd-63V 0.047ufd-63V 4.7ufd-35V 100.0ufd-35V 0.047ufd-400VDC 0.047ufd-50V 1.5A-600V	Ceramic Tubular Ceramic Tubular Electrolytic Ceramic Tubular Non-Polar Metal Film Ceramic Tubular Metal Film Metal Film Metal Film Electrolytic Electrolytic Metal Film Rifa or Wima Electrolytic 1N4005GP 1N5397GP LM358P LM324	Capacitor Diode Diode Dual Op-Amp Quad Op-Amp	
MOV1 PB1 O1.3 O2 O4 PB1 RB2 RB3 RB4 RB5.16.18.23 RB6.16.18.23 RB6.16.18.23 RB7.12.25 RB7 RB10 RB11 RB13.35 RB17 RB17 RB18 RB17 RB19 RB17 RB19 RB17 RB19 RB17 RB19 RB17 RB19 RB19 RB19 RB19 RB19 RB19 RB19 RB19	275V 42.5A-600VDC 0.6A-40V 0.6A-40V 0.8A-50V 10K-0.125W-10% 5K-5W-20% 25K-0.125W-5% 47K-0.25W-5% 47K-0.25W-5% 3.3K-0.25W-5% 500K-0.125W-10% 5.6K-0.25W-5% 56K-0.25W-5% 22K-0.25W-5% 52K-0.25W-5% 52K-0.25W-5% 560K-0.25W-5% 560K-0.25W-5% 560K-0.25W-5% 560K-0.25W-5% 560K-0.25W-5% 560K-0.25W-5% 12K-7W-5% 62K-0.25W-5% 12K-7W-5% 62K-0.25W-5% 12K-0.25W-5% 12K-0.125W-10% 10K-0.25W-5% 18K-0.25W-5% 18K-0.25W-5% 18K-0.25W-5% 18K-0.25W-5% 18K-0.25W-5% 12V-1W-5%	V275LA20AX1300 B612F-2 (Igt. 30 ma Max) 2N4403 2N4401 S347S101E PTC-10YV PTC-10YV Carbon Film	Transient Suppressor Power Bridge Small Signal Transistor Small Signal Transistor Small Signal SCR Max Trimpot Main Speed Pot Min Trimpot Resistor	

^{*}R21 is (2) 006 ohm-5W-5% resistors wired in parallel

[&]quot;No component or jumper used on printed circuit board. An 82K-0.5W-5% resistor is installed externally on terminal block.

SECTION VI (B) KBCC™-255 SPEED CONTROL SCHEMATIC





KB ELECTRONICS, INC.

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